TERMS OF REFERENCE FOR INDIVIDUAL COMBATANT WORKSHOP

As a guide in assessing the current state of the art in modeling the behavior of the IC in a military environment, the following Terms of Reference (TOR) have been developed. The TOR have been divided into the following categories:

I. Simulation Requirements: The development of any effective software system is driven by the user requirements and bounded by available resources of time/technology/personnel. What requirements are you trying to solve and in what timeframe?

II. There are several key factors which focus the simulation of individuals in a military operation as opposed to personnel operating in a non-threatening environment. These include representation of the effects of the following:

A. **Physical Battle Environment**: The IC must be cognizant of the physical battle environment, its changing nature and the opportunities it presents for completion of his/her tasks.

1) What level(s) of terrain resolution/features can be represented in your model (e.g., 100 m, 10 m, surface type, cultural features and vegetation)?

2) How dynamic are these features (i.e., what kind if update rates are supported)? Does your model represent dynamic terrain (shell holes, craters, collateral damage to structures, etc.)?

3) Does your model support operate in real-time and/or coordinate with real-time distributed processes?

4) What theaters of operation and/or terrain specific mission aspects does your model represent (e.g., MOUT, jungle, desert)?

5) Does your model include phenomenology effects (e.g., weather, illumination, hydrology, visibility, obscurants, etc.,)?

B. **Mission**: The individual tasks or goals are defined within the context of a military mission.

1) What military operations does your model (e.g., MOUT, OOTW, non-lethal, humanitarian) represent?

2) What level of detail or echelon of command does your model specify on tasks? Are military operations broken into discrete tasks? Are these tasks performed by units, individuals, or a combination? How detailed is the representation of tasks?

3) Does your model play "casualty evacuation" and casualty return?

C. **Soldier State**: Under the high stress conditions of the physical battle environment, simulating the state of the individual becomes an important factor in simulating behavior. This includes both the physiological condition and the psychological status of the IC, those attributes of the IC which may be affected by the battlefield environment, and in turn affect the IC's task performance. It may be helpful to couch your response to these questions in terms of such attributes as:

sensory/perceptual
cognitive
social/emotional
physical
knowledge

1) How does your model represent the infantry man's situational awareness -- the individual's internal understanding of the environment and tactical situation.

2) How does your model represent the individual's knowledge (awareness) of change in the combat status for his/her unit? Does the individual know when his/her unit has accomplished it's mission? Had it's mission modified? Other units?

3) Does your model assume the IC has perfect knowledge of the environment? For example, does your model allow the IC to get lost? Does your model allow the IC to misidentify/engage friendly units? Does your model provide the IC perfect knowledge of battle damage and casualties?

4) How does your model represent IC state, considering such things as casualty/injury status, food/sleep deprivation, motivation, training status, skill level?

5) How is communication represented at the level of the individual in your model/simulation?

6) What does the individual combatant know about the enemy situation?

7) To what extent does your model have task dependent definition of incapacitation or casualty, i.e., can injuries or other state decrements prevent performance of some tasks, but not others, or degrade task performance in different degrees depending on the task?

8) Is fear of injury a represented feature, i.e., does the IC fear certain injuries, and become cautious in this/her actions if they perceive the chance of an injury)? Are there similar constraints for other psychological conditions?

9) Does your model represent cultural differences, and if so, how?

10) Does your model represent the gender of the IC?

11 Do you model any of the capabilities, limitations, and biases characteristic of human decision makers (e.g., learning, fatigue, stress, cognitive style), and if so, how?

D. **Dynamic Behavioral Response** (Reactive/Proactive): These questions deal with the ability of the simulated IC to react to the physical battlefield environment cues by altering current behaviors or initiating new ones (Reactive Response), or to interpret the physical battlefield environment and respond to perceived or anticipated conditions (Proactive Response). Certainly different levels of complexity are required for each of these representations, so it may be helpful to distinguish between these two types of responses in your discussion.

1) Does your model include the IC “reasoning” about the future at any level (e.g., modify planned actions based on such events as the loss of a buddy on the flank)? How?

2) Is the IC behavior in your model triggered by simulated events that would correspond to sensory/perceptual cues (i.e., sounds, sights, smells), or is it caused by cascading events in the simulation architecture (i.e., does a detection event automatically generate a fire event)

3) Does your model permit stressors/enhancers to affect individual performance, and if so, how?

4) How is communication represented at the level of the IC in your model/simulation?

5) Does your model represent command and control to the level of the IC? What sources of data does the IC have to determine the changing battle situation, and what kind of task/behavioral alternatives are available to respond to changes?

6) What role does the “human in the loop” (HITL) play in your mode/simulation? What is the optimal role ?

III. Design/Architecture. No simulation exists without the infrastructure of an architecture of services and a fundamental philosophy of design. The difficulty of representing complex human behavior has lead many developers to use a human operator as a practical “stand in” where requirements go beyond the state of the art.

1) At what level are behaviors represented by HITL?

2) How does your model of the IC relate behavior to doctrine?

3) What is your methodology of representing individuals (e.g., psychological, animation, physics-based/anthropometric)?

Why did you choose that methodology?

What specific technology did you use (i.e., taxonomic classification, artificial intelligence, etc.)?

What are your methodology's strengths?

What are the weaknesses of your methodology?

What are the risks associated with your methodology?

4) Does your model play the OPFOR and GRAYFOR at the same level as it plays the Blue Forces?

IV. Other Issues

1) What have you done to verify and validate(V&V) your model's representation of behaviors? Can you address specific application domains for which you feel your model is most valid? Least valid?

2) What data (empirical data/real world results) did you have access to? Did this influence your choice of methodology, and if so, how?

3) What are the primary issues you are currently facing simulating the individual combatant?

4) What are the most significant technical challenges you are currently facing with your model/simulation?

What solutions did you come up with? What was the supporting rationale for that solution/methodology?

5) What are the areas that you feel theoretical research needs to be conducted?

6) Are there areas where you feel important applications can be developed, given time and funding?

7) What lessons or "tricks of the trade" have been learned as a result of your efforts that could benefit other projects attempting to model the individual combatant?

8) If you could start over what would you do differently? Why?

Certainly the above list of issues (although possibly exhausting) is not exhaustive and you are invited to add a discussion of any others (either solved or unsolved) you have encountered as your system has been developed. It is input from experts of your stature that will help provide DMSO with a solid technical basis for Authoritative Representation of Human Behavior and provide the proper tool set for emerging OSD objectives in modeling and simulation.